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(71)Applicant : **TANITA:KK**
(72)Inventor : **NISHIZAWA YOSHIYUKI**

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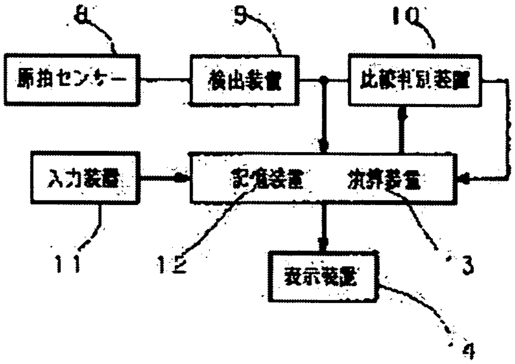
(54) SYSTEM FOR MEASURING CONSUMED CALORIE

(57)Abstract:
PURPOSE: To provide a system capable of displaying a consumed calorific value with ease by first storing and setting the sex, age, height, weight, fats ratio, and a pulse rate of a subject under examination when he is at rest and then by inputting a pulse rate after initialization into an arithmetic system according to measurement condition.

CONSTITUTION: Data on the sex, age, height, weight, and body fats ratio of a subject under examination which are inputted through an input unit 11, and data on a pulse rate A when the subject is at rest detected by means of a sensor 8, and a detection unit 9 are stored and set in a memory 12; an arithmetic processor 13 selects an arithmetic system according to the height condition and measurement condition. After initialization, a discriminator 10 compares and decides on whether a pulse rate X measured after initialization is greater or smaller than the pulse rate A measured when the subject is standing at rest and selects an applicable arithmetic system, that is, an arithmetic system applied when the subject is at rest or an arithmetic system applied when he is in motion; whereupon the measured pulse rate X is input and the arithmetic processor 13 computes a consumed calorific value Y (Kcal/ min), which is shown on a display unit 14.



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[Date of extinction of right]

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CLAIMS

[Claim(s)]
[Claim 1] The equipment which makes a constant a pulse measuring device, the sex of an operating personnel-ed, age, height, weight, and a body fat percentage, and carries out storage setting out, The equipment which compares with the measurement pulse rate and said resting period pulse rate after setting out the equipment which measures the pulse rate of a resting period and carries out storage setting out, the equipment which computes a consumption calorie by distinguishing the equipment which distinguishes whether it is a condition at the time of measurement at the motion time, or it is a resting period, whether it is at the motion time, or it is a resting period, and applying it to operation expression or resting period operation expression at the time of motion, respectively -- and The pulse rate measurement type consumption calorie meter which computes and displays the consumption calorie of an operating personnel-ed from the pulse rate measured value characterized by having equipment which displays the computed result.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] It is related with the consumption calorie meter which calculates and displays a living body's consumption calorie, and the electronic formula consumption calorie meter which calculates and displays a consumption calorie from the pulse rate measured especially.
[0002]
[Description of the Prior Art] The consumption calorie meter which computes and displays a consumption calorie from the pulse rate which the former measured CO2 according to a gas analyzer beforehand Measure a pulse rate to measurement and coincidence of an amount, and the consumption calorie of an operating-personnel-ed individual and the relational expression of a pulse rate are written in in a data write-in circuit. As shown in the thing and patent application No. 117672 [Heisei five to] which compute a consumption calorie by measuring the pulse rate of an operating personnel-ed henceforth Beforehand, by making sex of an operating personnel-ed, age, height, and weight into a constant, carry out storage setting out, and measure the pulse rate of a resting period in advance, and storage setting out is carried out. It was what computes a consumption calorie by comparing the measurement pulse rate and said resting period pulse rate after setting out, and distinguishing whether it is at the motion time, or it is a resting period, and applying it to operation expression or resting period operation expression at the time of motion, respectively.
[0003]
[Problem(s) to be Solved by the Invention] The approach of using a gas analyzer for beforehand [conventional] The mask equipped with the close blowdown pipe is pressed and attached in a living body's (operating personnel-ed) face. Exhalation is accumulated to the Douglas bag carried on the back through the pipe. An after analyzer analyzes or Exhalation was sent to the direct-method-of-analysis machine through the pipe, the big corporal burden was hung on the operating personnel-ed, and only the expert of actuation and measurement could use it, but there was a trouble of being unable to perform calculation of a consumption calorie according to the bodily features of the operating-personnel-ed individual who cannot provide as an object for general for this reason.
[0004]
[Means for Solving the Problem] A consumption calorie is computed by carrying out storage setting out, measuring the pulse rate of a resting period in advance, carrying out storage setting out, comparing the measurement pulse rate and said resting period pulse rate after setting out, distinguishing whether it is at the motion time, or it is a resting period, and applying [by making the sex of an operating personnel-ed, age height, weight, and a body fat percentage into a constant,] it to operation expression or resting period operation expression beforehand, at the time of motion, respectively.
[0005]
[Function] In the pulse rate measurement type consumption calorie meter of this invention, the various measurement which drew the operation expression which computes a consumption calorie, and its operation expression from the measured pulse rate is explained. It is already in ** that a pulse rate and a

consumption calorie are in proportionality in JP,2-80029,A which has proposed the consumption calorie meter which computes the consumption calorie of an operating-personnel-ed individual, and the relational expression of a pulse rate by measuring a pulse rate to the measurement and coincidence of a consumption calorie by a gas analyzer etc., and computes a consumption calorie by writing in the set circuit of a consumption calorie meter, and measuring the pulse rate of an operating personnel-ed henceforth.

[0006] Moreover, as shown in the graph of drawing 3 , it is -206 and 17th volume (1990) 201 medicine [Hirosaki / 40 volume / No. 1 (March, Showa 63)] 60of welfare pension hospital annual report-69 grade that a pulse rate and the relation of a consumption calorie (oxygen demand) are expressed with two relational expression, the relational expression of a resting period and the relational expression at the time of motion, and it is already known. These various measurement is aimed at obtaining the data for drawing that relational expression (operation expression).

[0007] An operating personnel-ed shows the list in the table of drawing 7 and drawing 8 by 12 women and nine men. Measurement asked for a pulse rate and the relation of a consumption calorie about the rest condition and motion condition of the content which are shown in the table of drawing 6 . Measurement of a pulse rate takes the data in every 30 seconds, the measuring method of a consumption calorie is the treadmill method at the time of a treadmill walk, in ergometer motion, it is the ergometer method, and others are the Douglas-bag methods.

[0008] The list of the correlation coefficients of the list of regression and resting period regression and the value computed from the operation expression which was called for from each regression, and which carries out a back theory, and the measured value by the gas analyzer is shown at the time of motion of each ******** drawn from the result of measurement by drawing 7 and drawing 8 .

[0009] When the average of the multiplier of X will serve as a male 0.01808 and a woman 0.00895 if a resting period is looked at, and a pulse rate is set to X and it sets [a consumption calorie] a basal metabolic rate (value during 1 minute) to C for Y (a part for kcal/), and a standing position resting period pulse rate at the time of A and measurement, a resting period average type is a male. Y=0.01808 X+C -0.01808 (A-20.25)
Woman Y=0.00895 X+C -0.00895 (A-20.25)
A next door, resting period operation expression In the case of a male Y=0.01808(X-A +20.25)+C -- (1) Formula In the case of a woman Y=0.00895(X-A +20.25)+C -- (2) A formula is drawn. "20.25" in a formula is the average of the difference of a side lying position resting period pulse rate and a standing position resting period pulse rate.

[0010] When the time of motion is looked at, a male is proportional to that (LBM/Ht2) to which the multiplier of X **(ed) the fat-free mass (weight-body fat percentage * weight) by square of height (m) by there being individual difference unlike a resting period, is in inverse proportion to a body fat percentage (%FAT) and age, and is LBM/Ht2 about a female multiplier. Proportionally, although it was in inverse proportion to %FAT, the clear relation with age was not seen. From the multiple regression analysis with these variables, the regression about the multiplier of X of a formula was drawn at the time of the following motion. He is a male when the multiplier of X of a formula is set to B at the time of motion. B1=0.0109(LBM/Ht2)-0.0023(%FAT)-0.0007 (age) -0.0211 woman It is set to B-2=0.0140 (LBM/Ht2)-0.0012(%FAT)-0.1254. It is operation expression at the time of motion. In the case of a male Y=B 1 (X-A)+C+0.3645 .... (3) Formula In the case of a woman Y=B-2 +C+0.1812 (X-A) .. (4) It becomes a formula.

[0011] C is based on a basal metabolism standard c (kcal/m2/o'clock) here per surface area of a body of the side lying position resting period of the Showa 44 calculation of the announcement of the Ministry of Health and Welfare showing in the table of drawing 5 . C(part for kcal/) =c*a/60 .... (5) It is the value computed from the formula. a is the surface area of a body (cm2), and is an announcement of the Ministry of Health and Welfare. 0 years old a=W0.473*H0.655*95.68 .... (6) Formula 1-5 years old a=W0.423*H0.362*381.89 -- (7) Formula Six or more years old a=W0.444*H0.663*88.83 .. (8) Compute from a formula. Here, W is weight (kg) and H is height (cm). A consumption calorie is computed by the formula appropriate for the conditions at the time of the physical conditions of an operating personnel-ed and measurement being chosen from the above formulas.

[0012] As the correlation coefficient R of the value of the consumption calorie computed by operation expression from the measured value of the pulse rate in the various conditions explained above and the measured value by the gas analyzer is shown in drawing 7 and drawing 8 , it is 0.90-0.98 and operation expression is considered to be an appropriate thing.

[0013]

[Example] Hereafter, one example of this invention is explained based on a drawing. Although it is drawing of the type which drawing in which (A) of drawing 1 shows the display of the consumption calorie meter of one example of this invention and the appearance of a pulse sensor, drawing in which (B) shows the busy condition, and drawing 2 are drawings of the wrist watch type consumption calorie meter of other examples of this invention, and attaches a pulse sensor in a finger As shown in the example of publication of unexamined utility model application Heisei 4-90307 and JP,1-270850,A, since a pulse sensor can also be arranged in the field in contact with the rear face of a wrist watch type consumption calorie meter, i.e., an arm, it can also lose the code which ties a consumption calorie meter body and a pulse sensor. Moreover, although not illustrated, it can also be used, being able to equip sports equipments, such as ergometer and a treadmill.

[0014] The graph with which drawing 3 shows the relation between a pulse rate and a consumption calorie, the flow chart with which drawing 4 shows actuation of the consumption calorie meter of one example of this invention, Drawing 5 per surface area of a body at the time of the Showa 44 calculation of an announcement of the Ministry of Health and Welfare The table of a basal metabolism standard, The chart of various kinds of Measuring conditions for drawing 6 to ask for a pulse rate and the relation of a consumption calorie, The chart of the correlation coefficient of drawing 7 , the regression by which 8 was drawn from the result of measurement, the value computed from operation expression, and the measured value by the gas analyzer, and drawing 9 are the block diagrams explaining the configuration of the consumption calorie meter of an example.

[0015] According to the block diagram of drawing 9 , the configuration of the consumption calorie meter of one example of this invention is explained. Storage setting out of the data of the resting period pulse rate A detected by the data of the sex inputted by the input device (11), age, height, weight, and a body fat percentage, the pulse sensor (8), and detection equipment (9) is carried out at storage (12), and each formula from (1) type of the preceding opinion to (8) types is completed by the arithmetic unit (13).

[0016] After initializing finishes, the value of the pulse rate X measured by the pulse sensor after setting out and detection equipment compares with whether to be larger than the standing position resting period pulse rate A or small and comparison distinction equipment (10), and distinguishes whether resting period operation expression is applied or operation expression is applied at the time of motion. If the operation expression to apply is decided, the value of the measured pulse rate X will be assigned, the consumption calorie Y (a part for kcal/) will be computed by the arithmetic unit (13), and it will be displayed with a display (14).

[0017] Next, according to the flow chart of the actuation shown in drawing 4 , as for sex, the physical conditions of an operating personnel-ed explain as an example actuation of the consumption calorie meter of one example of this invention shown in drawing 1 about the case for male, 48 years-old [of age], height [of 165cm], weight [of 60kg], 20% [of body fat percentages], and 75 beat/of resting period pulse rates. First, the setting button (4) of a consumption calorie meter body (1) is pushed, the "**" beside "setting out" is indicated by burning, and it is in an initialization (step 100) condition.

[0018] "**" under "age" lights up at the same time the display of "**M] under "sex" will disappear and setting-out registration of the sex will be carried out, if mode ** (3) is pushed, make "**MW] under "sex" of a display turn on (step 101), "M" (male) is made to turn on by ** ** (6) and after (step 102) mode ** is pushed (step 103).

[0019] "**" under "height" lights up at the same time the display of "**" under "age" will disappear and setting-out registration of the age will be carried out, if ** ** (6) and ** ** (7) are pushed here, "48" of age is displayed on a numeric display (step 104) and mode ** (3) is pushed (step 105). "**" under "weight" lights up at the same time the display of "**" under "height" will disappear and setting-out registration of the height will be carried out, if ** ** (6) and ** ** (7) are pushed, "165" of height is displayed on a numeric display (step 106) and mode ** (3) is pushed continuously (step 107).

[0020] "**" under "the rate of a fat" lights up at the same time the display of "**" under weight will disappear and setting-out registration of the weight will be carried out, if ** ** (6) and ** ** (7) are pushed similarly, "60" of weight is displayed on a numeric display (step 108) and mode ** (3) is pushed (step 109).

[0021] "**" beside a "pulse" lights up at the same time the display of "**" under the rate of a fat will disappear and setting-out registration of the rate of a fat will be carried out, if ** ** (6) and ** ** (7) are pushed similarly, "20" of the rate of a fat is displayed on a numeric display (step 110) and mode ** (3) is pushed (step 111). Attaching in an earlobe the pulse sensor (5) connected to the consumption calorie meter body (1), and measuring a pulse with beginning (step 112) with a rest standing position position A part for 75 beat (step 113)/of pulse rates measured about 2 minutes after the timer built in the body worked is memorized as a standing position resting period pulse rate (it corresponds to the pulse rate of the intersection A point of the motion operation line on the right-hand side of drawing 3 , and a left-hand side resting period operation line). a setting button (4) -- pushing (step 114) -- the display of "**" beside a pulse disappears, and setting-out registration of the standing position resting period pulse rate is carried out (step 115), simultaneously "**" beside "CAL" lights up.

[0022] Here, since all setting out was completed, if a setting button (4) is pushed and the display of "**" beside "setting out" of a display puts out the light, an established state will be completed and it will go into a measurement condition. The display of a "pulse" and the display of "CAL" (consumption calorie) can be switched and specified by pushing mode ** (3) in the state of measurement. When condition changes and a resting period pulse rate changes, it can respond easily only by redoing measurement setting-out registration of the standing position resting period pulse rate of step 111.

[0023] In the case of a **** operating personnel, it will be calculated by applying setups to (8), (5), and (1) type, consequently the consumption calorie to the resting period pulse rate 75 is computed with a part for 1.300kcal/. Henceforth, if motion of a jogging etc. is started and a pulse rate is set to 130, since it is larger than the resting period pulse rate 75, (3) types which are operation expression at the time of motion will be applied, and a consumption calorie will be computed with a part for 6.415kcal/.

[0024] Moreover, if a pulse rate is set to 65 in the state of a seating position etc., since it is smaller than the resting period pulse rate 75, (1) type which is resting period operation expression will be applied, and a consumption calorie will be computed with a part for 1.121kcal/. Moreover, if a pulse rate is set to 50 in the state of a side lying position etc., since it is smaller than presumed side lying position rest pulse rate (75-20.25) =54.75, a part for 0.935kcal/which is the value of basal metabolism will be applied as it is. The computed value is accumulated and is displayed on a display (2) as a consumption calorie. In addition, although measurement of a pulse rate is 10-second spacing and calculation of a consumption calorie is performed at intervals of 1 minute in this example, according to the data-processing capacity of C.P.U currently used etc., measurement / operation spacing is changeable. Thus, a consumption calorie is easily computable henceforth only by measuring a pulse in an earlobe, an arm, etc. only by setting up physical conditions, and measuring and setting up a resting period pulse rate in advance.

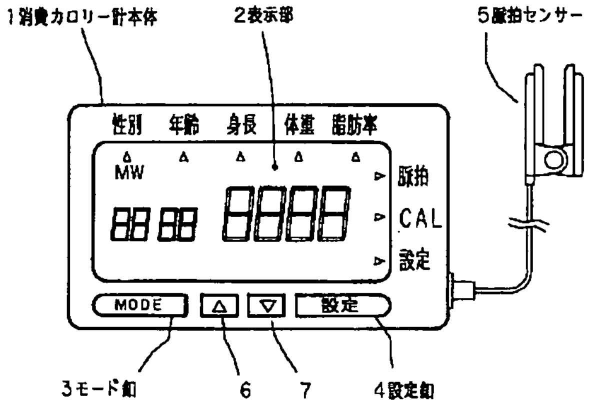
[0025]

[Effect of the Invention] As stated above, according to the consumption calorie meter of this invention, measurement of the operating-personnel-ed individual by the gas analyzer is beforehand unnecessary as well as an operating personnel-ed not using a gas analyzer at the time of measurement. A corporal burden is not applied to an operating personnel-ed only by measuring a pulse in the earlobe of an operating personnel-ed, a finger, an arm, etc. There is outstanding effectiveness that can respond easily only by redoing measurement setting-out registration of a standing position resting period pulse rate even when condition changes and a resting period pulse rate changes, can use it easily even if it is not the expert of actuation and measurement, therefore measurement of the part on the 1st in an everyday life condition also becomes possible. Moreover, it became possible by having added the explanatory variable of a body fat percentage to the presumed type this time to take out the value of the consumption energy which corresponded according to the individual difference of consumption energy.

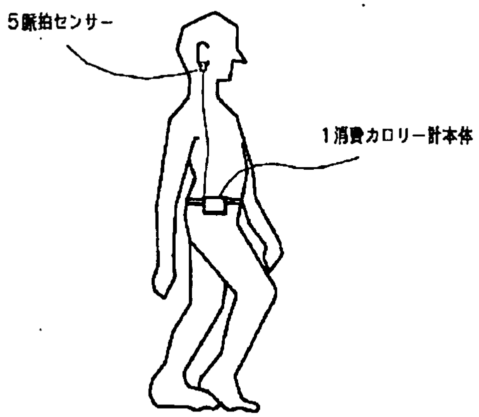
[Translation done.]

Drawing selection drawing 1

(A)

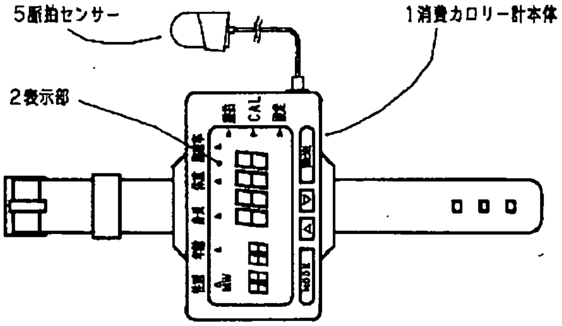


(B)

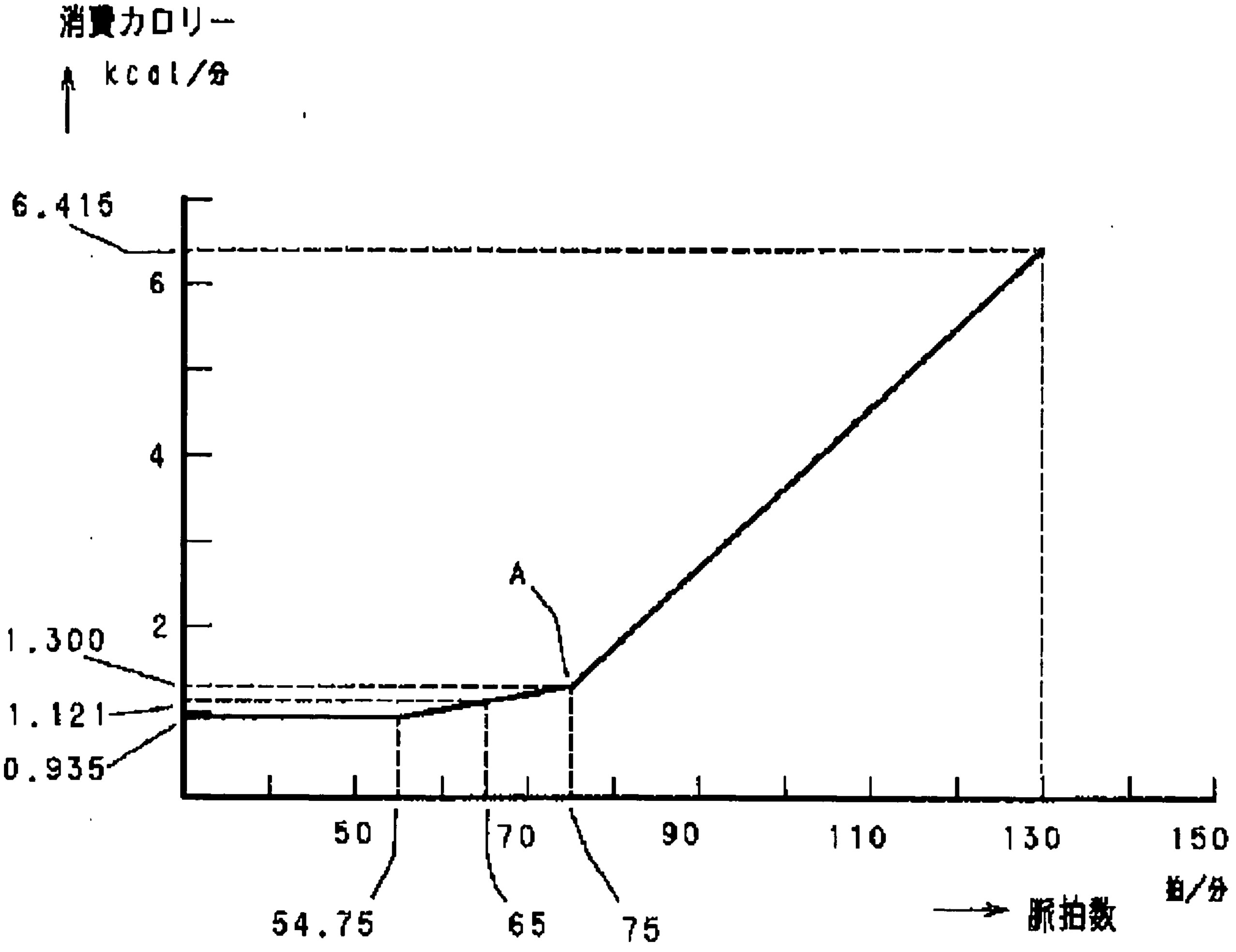


[Translation done.]

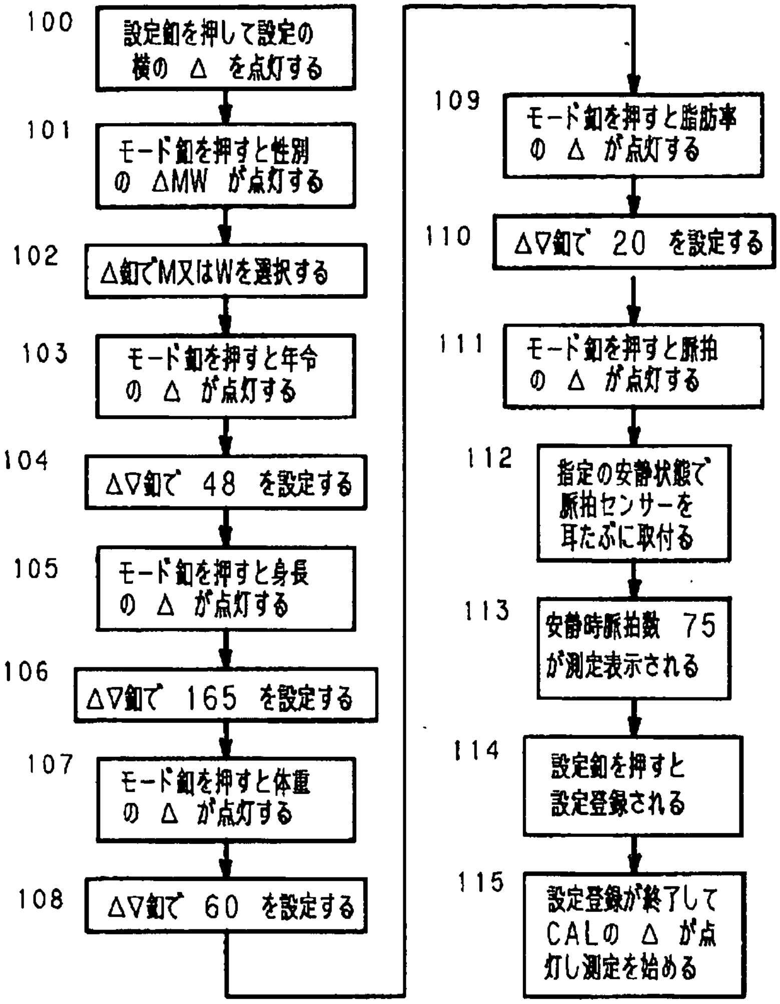
Drawing selection drawing 2



[Translation done.]

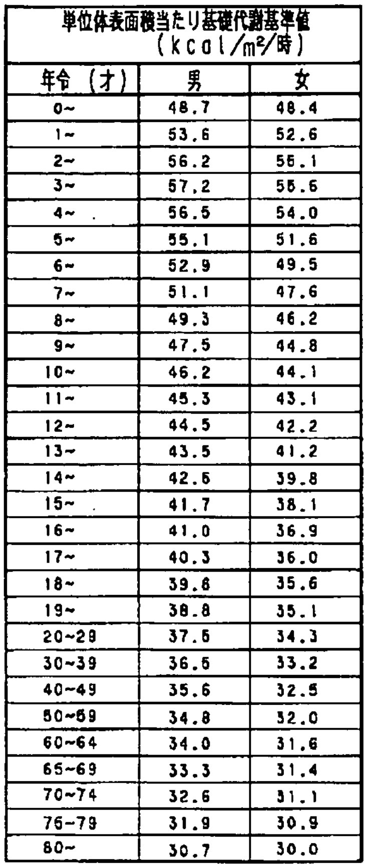

消費カロリー
kcal/分
6.415
6
4
2
1.300
1.121
0.935
A
50
70
90
110
130
150
拍/分
54.75
65
75
脈拍数

Drawing selection drawing 4



[Translation done.]

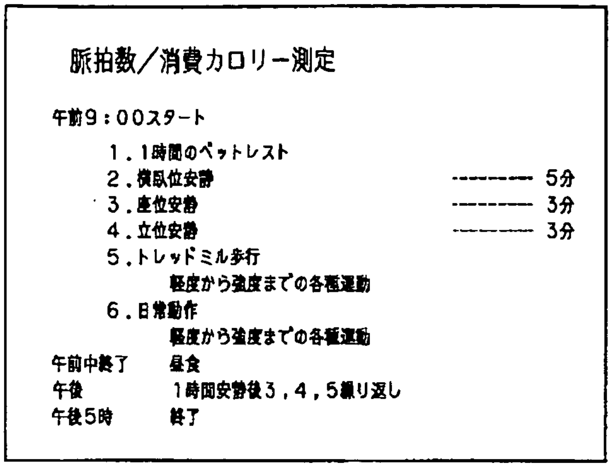
Drawing selection drawing 5



単位体表面積当たり基礎代謝基準値（kcal/m²/時）		
年令（才）	男	女
0~	48.7	48.4
1~	53.6	52.6
2~	56.2	55.1
3~	57.2	55.6
4~	56.5	54.0
5~	55.1	51.6
6~	52.9	49.5
7~	51.1	47.6
8~	49.3	46.2
9~	47.5	44.8
10~	46.2	44.1
11~	45.3	43.1
12~	44.5	42.2
13~	43.5	41.2
14~	42.6	39.8
15~	41.7	38.1
16~	41.0	36.9
17~	40.3	36.0
18~	39.6	35.6
19~	38.8	35.1
20~29	37.5	34.3
30~39	36.5	33.2
40~49	35.6	32.5
50~59	34.8	32.0
60~64	34.0	31.6
65~69	33.3	31.4
70~74	32.6	31.1
75~79	31.9	30.9
80~	30.7	30.0

[Translation done.]

Drawing selection drawing 6



脈拍数／消費カロリー測定

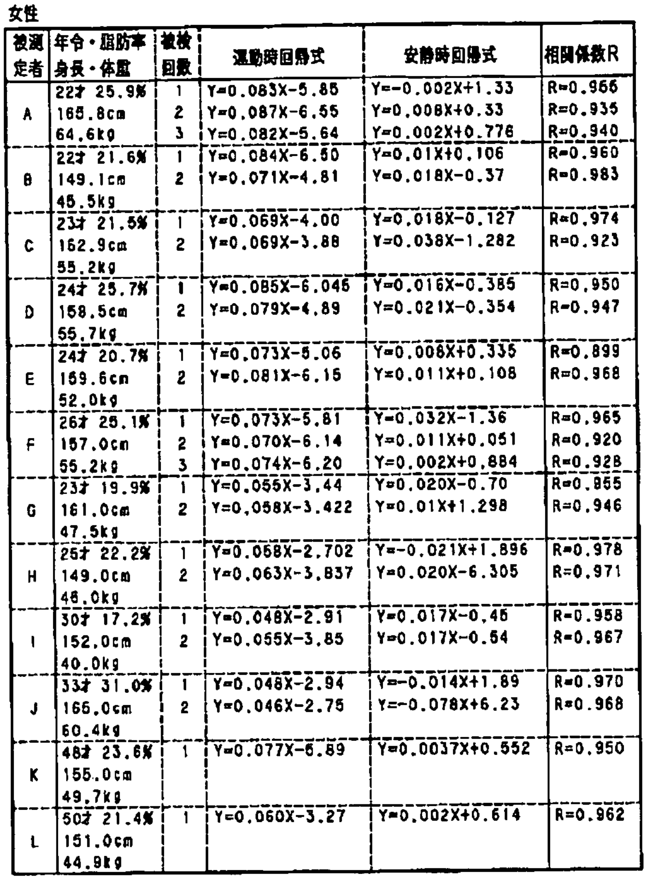
午前9：00スタート

1．1時間のベットレスト
2．横臥位安静 -------- 5分
3．座位安静 -------- 3分
4．立位安静 -------- 3分
5．トレッドミル歩行
　　軽度から強度までの各種運動
6．日常動作
　　軽度から強度までの各種運動

午前中終了　昼食
午後　1時間安静後3，4，5繰り返し
午後5時　終了

[Translation done.]

Drawing selection drawing 7



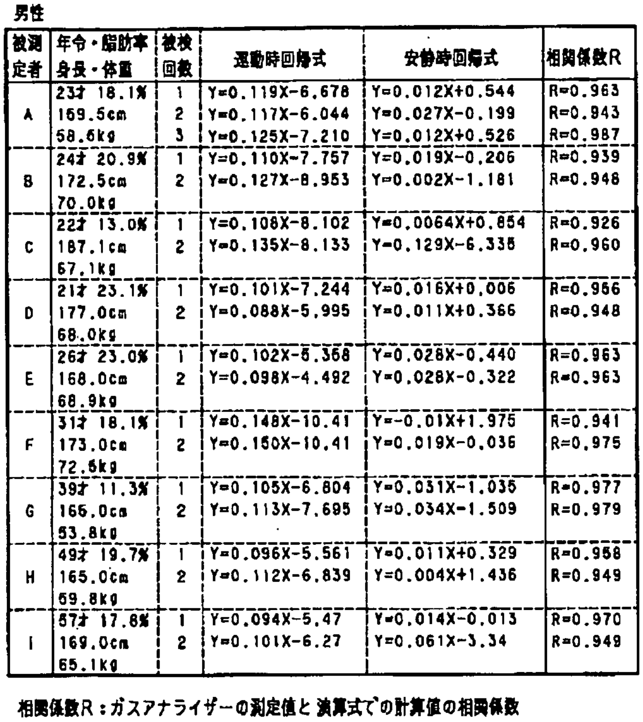
女性

被測定者	年令・脂肪率 身長・体重	被検回数	運動時回帰式	安静時回帰式	相関係数R
A	22才 25.9%	1	Y=0.083X-5.85	Y=-0.002X+1.33	R=0.966
	165.8cm	2	Y=0.087X-6.55	Y=0.008X+0.33	R=0.935
	64.6kg	3	Y=0.082X-5.64	Y=0.002X+0.776	R=0.940
B	22才 21.6%	1	Y=0.084X-6.50	Y=0.01X+0.106	R=0.960
	149.1cm	2	Y=0.071X-4.81	Y=0.018X-0.37	R=0.983
	45.5kg				
C	23才 21.5%	1	Y=0.069X-4.00	Y=0.018X-0.127	R=0.974
	162.9cm	2	Y=0.069X-3.88	Y=0.038X-1.282	R=0.923
	55.2kg				
D	24才 25.7%	1	Y=0.085X-6.045	Y=0.016X-0.385	R=0.950
	158.5cm	2	Y=0.079X-4.89	Y=0.021X-0.354	R=0.947
	55.7kg				
E	24才 20.7%	1	Y=0.073X-5.06	Y=0.008X+0.335	R=0.899
	159.6cm	2	Y=0.081X-6.15	Y=0.011X+0.108	R=0.968
	52.0kg				
F	26才 25.1%	1	Y=0.073X-5.81	Y=0.032X-1.36	R=0.965
	157.0cm	2	Y=0.070X-6.14	Y=0.011X+0.051	R=0.920
	55.2kg	3	Y=0.074X-6.20	Y=0.002X+0.884	R=0.928
G	23才 19.9%	1	Y=0.055X-3.44	Y=0.020X-0.70	R=0.855
	161.0cm	2	Y=0.058X-3.422	Y=0.01X+1.298	R=0.946
	47.5kg				
H	25才 22.2%	1	Y=0.058X-2.702	Y=-0.021X+1.896	R=0.978
	149.0cm	2	Y=0.063X-3.837	Y=0.020X-6.305	R=0.971
	46.0kg				
I	30才 17.2%	1	Y=0.048X-2.91	Y=0.017X-0.45	R=0.958
	152.0cm	2	Y=0.055X-3.85	Y=0.017X-0.54	R=0.967
	40.0kg				
J	33才 31.0%	1	Y=0.048X-2.94	Y=-0.014X+1.89	R=0.970
	166.0cm	2	Y=0.046X-2.75	Y=-0.078X+6.23	R=0.968
	60.4kg				
K	48才 23.6%	1	Y=0.077X-6.89	Y=0.0037X+0.552	R=0.950
	155.0cm				
	49.7kg				
L	50才 21.4%	1	Y=0.060X-3.27	Y=0.002X+0.614	R=0.962
	151.0cm				
	44.9kg				

相関係数R：ガスアナライザーの測定値と演算式での計算値の相関係数

[Translation done.]

Drawing selection drawing 8



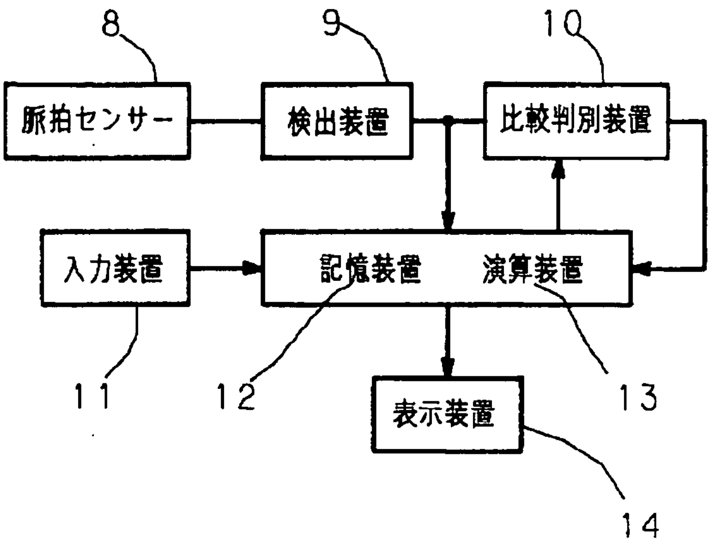
男性

被測定者	年令・脂肪率 身長・体重	被検回数	運動時回帰式	安静時回帰式	相関係数R
A	23才 18.1%	1	Y=0.119X-6.678	Y=0.012X+0.544	R=0.963
	169.5cm	2	Y=0.117X-6.044	Y=0.027X-0.199	R=0.943
	58.6kg	3	Y=0.125X-7.210	Y=0.012X+0.526	R=0.987
B	24才 20.9%	1	Y=0.110X-7.757	Y=0.019X-0.206	R=0.939
	172.5cm	2	Y=0.127X-8.953	Y=0.002X-1.181	R=0.948
	70.0kg				
C	22才 13.0%	1	Y=0.108X-8.102	Y=0.0064X+0.854	R=0.926
	187.1cm	2	Y=0.135X-8.133	Y=0.129X-6.338	R=0.960
	67.1kg				
D	21才 23.1%	1	Y=0.101X-7.244	Y=0.016X+0.006	R=0.966
	177.0cm	2	Y=0.088X-5.995	Y=0.011X+0.366	R=0.948
	68.0kg				
E	26才 23.0%	1	Y=0.102X-5.368	Y=0.028X-0.440	R=0.963
	168.0cm	2	Y=0.098X-4.492	Y=0.028X-0.322	R=0.963
	68.9kg				
F	31才 18.1%	1	Y=0.148X-10.41	Y=-0.01X+1.975	R=0.941
	173.0cm	2	Y=0.150X-10.41	Y=0.019X-0.036	R=0.975
	72.5kg				
G	39才 11.3%	1	Y=0.105X-6.804	Y=0.031X-1.035	R=0.977
	166.0cm	2	Y=0.113X-7.695	Y=0.034X-1.509	R=0.979
	53.8kg				
H	49才 19.7%	1	Y=0.096X-5.561	Y=0.011X+0.329	R=0.958
	165.0cm	2	Y=0.112X-6.839	Y=0.004X+1.436	R=0.949
	59.8kg				
I	57才 17.8%	1	Y=0.094X-5.47	Y=0.014X-0.013	R=0.970
	169.0cm	2	Y=0.101X-6.27	Y=0.061X-3.34	R=0.949
	65.1kg				

相関係数R：ガスアナライザーの測定値と演算式での計算値の相関係数

[Translation done.]

Drawing selection drawing 9



[Translation done.]